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ABSTRACT

High personnel loss rates among recruits who have signed up for the Army's Delayed Entry Program (DEP) are becoming an increasing problem for DEP program managers. Therefore, a research project was conducted to examine DEP loss as a function of sociodemography and policy variables at the microdata level. Two DEP loss models were created. The first included high school graduates and nongraduates, and the second included high school seniors. In each model, several scenarios were staged to measure different combinations of the following variables: age, gender, Armed Forces Qualification Test (AFQT) score, education, contracted DEP length, military occupational specialty (MOS), region of the country, and enlistment and incentive options. A logistic regression (logit) model that estimates loss probabilities on an individual basis was specified, and categories of high- and low-risk individuals were identified. The multivariate analysis revealed that the following variables were associated with higher DEP loss: signing up for a longer DEP length, being female, choosing to participate in the Army College Fund, and being a high school graduate or nongraduate as opposed to a high school senior. The model was found to present a significant improvement over previous research because it permits measurement of the effects of changing several parameters simultaneously, thereby allowing for the prediction of DEP loss probability on an individual basis. (MN)

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Technical Report 666

A Microdata Model of Delayed Entry Program (DEP) Behavior

Chester E. Phillips and Edward J. Schmitz

Manpower and Personnel Policy Research Group
Manpower and Personnel Research Laboratory

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A growing problem associated with the Army's Delayed Entry Program is that of DEP loss. This research examines DEP loss as a function of sociodemographic and policy variables at the midrodata level. A logistic regression (logit) model is specified, estimating loss probabilities on an individual basis. Categories of high and low loss risk individuals are identified. This multivariate analysis represents a major step toward understanding factors associated with DEP loss and provides valuable information for the development of an improved policy of DEP management.

Technical Report 666

A Microdata Model of Delayed Entry Program (DEP) Behavior

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FOREWORD

The Manpower and Personnel Policy Research Group of the Army Research Institute for the Behavioral and Social Sciences (ARI) is concerned with developing more effective methods for utilizing Army manpower resources. This research represents a step toward gaining a better understanding of the effects of the Delayed Entry Program. Endeavors such as this may lead to more effective methods for managing scarce manpower resources.

EDGAR M. JOHNSON
Technical Director

A MICRODATA MODEL OF DELAYED ENTRY PROGRAM (DEP) BEHAVIOR

EXECUTIVE SUMMARY

Requirement:

The Manpower and Personnel Policy Research Group (MPPRG) of the U.S. Army Research Institute examines personnel issues of particular importance to the Army. Personnel losses from the Delayed Entry Program (DEP) is one such issue. In this paper a model is developed to predict DEP loss. The model will provide an increased understanding of the DEP loss problem along with valuable information concerning identification of individuals most likely to become losses.

Procedure:

Two DEP loss models are created: one including high school graduates and nongraduates and a separate model for high school seniors. Maximum likelihood logistic regression (logit) estimates are made from individual data for the first half of FY82 and FY83.

Both individual characteristics and policy variables are used in the analysis. These include age, gender, race, AFQT score, education, contracted DEP length, training MOS, region of the country, and enlistment and incentive options. Scenarios are staged to measure the effect of different combinations of relevant variables.

Findings:

Several variables were found to have considerable influence in the prediction of DEP loss. Longer DEP lengths produced consistently higher loss rates. Education and gender were found to be significant, with high school seniors having lower predicted DEP loss probabilities than high school graduates or nongraduates having similar personal characteristics. Females were also shown to have higher predicted loss rates than males. Army College Fund (ACF) participation also consistently reduced an individual's loss probability.

The model presents a significant improvement over previous research because it permits measurement of the effects of changing several parameters simultaneously, ultimately arriving at a DEP loss probability for an individual. This allows for the identification of low and high risk categories. These categories ranged from male high school seniors (lowest risk) to female high school graduates (highest risk).

Utilization of Findings:

The results of this analysis can be best used to identify those individuals already within the system most likely to become DEP losses. With this understanding, it would become easier to prevent its occurrence by more efficiently allocating recruiting resources. Results can also be used in conjunction with one of the currently used forecasting models, obtaining a more accurate estimate of accessions.

A MICRODATA MODEL OF DELAYED ENTRY PROGRAM (DEP) BEHAVIOR

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I. INTRODUCTION

The Delayed Entry Program (DEP) has become an important management tool to aid recruiting and assure a smooth flow of accessions. It allows a person to delay the beginning of active duty up to 12 months after signing an enlistment contract.

Recently, there has been a rising trend in the number of persons dropping out of the DEP prior to accession. A growing concern of the Army, this problem (DEP loss) affects recruiting productivity and the filling of future training slots.

This paper examines the DEP loss problem. A microdata-level model is developed to predict its occurrence. The model is then used to identify certain "high risk" categories of individuals. The influence of Army policies upon DEP loss is also examined.

Section II examines the DEP loss problem in general. Current research on the subject is reviewed. Loss trends are reported. The third section explains model formulation, including data and methodology. Results of the model are used in several scenarios examining the effects of individual characteristics and alternative policy options.

II. THE DELAYED ENTRY PROGRAM

The Delayed Entry Program is a major organizational innovation assisting both recruiting and training. This section discussess the main features of the DEP, including some of its positive and negative aspects.

The DEP serves two direct purposes. It manages the flow of accessions and aids in attracting qualified individuals to the Army. Upon signing a contract, a person can either enter the DEP or become a "direct ship", and immediately access. In FY81 over 98 percent of all Army enlistees participated in the DEP (Schmitz and Nelson 1984). The program allows an

eligible individual up to 12 months before accessing. While in the program, an individual is considered a reservist, collecting no pay but accruing time in service for longevity raises.

DEP length varies by individual and current Army policy. For example, while a male non-prior service (NPS) AFQT category I-IIIA (above average) high school senior may be allowed to remain in the DEP for 12 months, a high school graduate with similar characteristics may only be permitted 3 months. Maximum permitted DEP length has also varied over time, depending upon accession goals of the Army. When immediate accession goals must be met, maximum DEP lengths will be shorter than when recruiting is not as constrained.

As previously noted, the DEP also produces several indirect impacts. Morey (1983) pointed out how the DEP aids recruiting by returning enlistees to their neighborhoods. The recruits are then able to positively influence their peers concerning an Army enlistment. The program serves as a management tool, allowing a smooth flow of accessions by spreading out the peaks and valleys of recruiting success. In addition, while an individual may not be able to obtain a desired Military Occupational Specialty (MOS) immediately, it may be available at a later date through the DEP. This could increase the contract signing likelihood for that individual. The DEP also allows the Army to tap the lucrative market of high school seniors, allowing completion of high school before accessing.

As previously noted, periodic adjustments are made in the time individuals are allowed to remain in the DEP. These policies are transmitted to the Military Entrance Processing Stations (MEPS) in the form of DEP control messages and are input to the REQUEST system. (The REQUEST system is a reservation system used by the Army guidance counselor at the MEPS, listing MOS and training slots for which an applicant is qualified.) In addition to limitations on DEP lengths for particular supply groups, closed MOS are specified. An example of a DEP control message is included as Appendix A. During the first six months of FY82, persons were not permitted to remain in the DEP beyond the end of the fiscal year (with exceptions made for infrequently scheduled training classes). Only high school seniors in test

categories I-IIIB were allowed the maximum DEP length. Other categories were not permitted to DEP beyond four months. While these were the general DEP policies for the first half of FY82, exceptions were made for those with special skills or enlisting in specific MOS.

Several disadvantages can be associated with the DEP. There are costs associated with running the program. The time that an individual remains in the DEP counts as time in the Army when base pay is calculated. This translates into more rapid advancement in pay grade for an individual, and therefore higher cost to the Army. It also counts as time in service when calculating retirement benefits. (This will be eliminated as of January 1, 1985, however.) Morey (1983) points out the inability the system would have to adapt if accession requirements were suddenly decreased, making the system relatively inflexible. Recruiter time is also spent keeping track of those in the DEP. (It is the duty of the recruiter to keep track of the individual in the DEP. If the person becomes a DEP loss, it is the recruiter's responsibility to find a replacement.) While the time devoted to managing persons in the DEP has not been estimated, it reduces time a recruiter spends attracting new recruits.

However, a limited amount of DEP loss may actually be desirable. Participation in the DEP has been shown to reduce later attrition. A Rand study (Buddin 1981) found lower attrition rates among DEP participants, particularly those remaining in the DEP over three months. Baldwin et al. (1982) also found lower attrition rates among DEP participants. Some who become DEP losses may have attrited at a later date. Since the cost of keeping a person in the DEP is likely to be lower than the cost incurred during and after training, it would be more cost effective to lose the individual early in the process, before too sizable an investment is made.

With widespread use of the DEP, the problem of DEP loss becomes extremely important. (A person who drops out of the DEP at any time prior to accessing will be defined a "DEP loss".) By the end of FY83, over 7 percent of all NPS AFQT category I-IIIA males were being lost in the DEP (USAREC 1984). A loss rate of over 11 percent for all participants was experienced early in 1984 (Maze 1984a), intensifying the situation.

Table 1 examines reasons for DEP loss for a sample of FY82 contracts. Medical disqualifications composed almost 25 percent of total losses. (For the purposes of this analysis, it will be assumed that those who become losses for medical reasons are spread evenly throughout the population.) An analysis of DEP loss for FY83 and the beginning of FY84 (USAREC briefing 1984) is in accordance with these results. That analysis found the four most common reasons for DEP loss to be apathy (refusal to enlist, failure to report, personal reasons), medical disqualification, moral disqualification, and the continuance of one's education.

TABLE 1

REASONS FOR DEP LOSS
(Sample-First six months of FY82)

	N	PERCENT
Medical Disq.	512	24.76
Apathy/Personal	330	17.39
Moral Disq.	276	14.54
Did not Graduate H.S.	205	10.80
Pursuit of Education	108	5.69
Pregnancy	86	4.53
Refused to Enlist	78	4.11
Did not Appear	72	3.79
Concealed Prior Service	43	2.27
Dependency Disq.	24	1.26
Hardship Disq.	22	1.16
No Longer Qualified	22	1.16
Temp. Disq./Denies Alt.	13	.69
Other	149	7.85
TOTAL		100.00

A recent analysis (Celeste 1984) examined characteristics of individuals associated with DEP loss. Using cohorts for FY81, FY82, and the first six months of FY83, the analysis examined loss rates by age, gender, AFQT category, month of contract, length of DEP, and MOS. Their findings include:

1. Lower AFQT category individuals were more likely to become DEP losses.
2. The ages associated with highest DEP loss rates were 18-19 and over 30.

3. Females had higher loss rates than males.
4. Higher loss rates were found where longer DEP lengths were contracted.
5. There was high variability in DEP loss within MOS and CMF.

To attract high quality individuals ("high quality" will refer to AFQT category I-IIIA HSGs and HSSRs) to specific MOS or enlistment terms, the Army currently employs a set of enlistment and incentive options. The enlistment options most often considered include:

- o Airborne - enlistment in an Airborne MOS.
- o Station of choice - this allows for selection of first duty station after training.
- o Training of choice - permits the enlistee to choose a specific skill.
- o Unit of choice - enables the enlistee to select a unit after basic training.
- o Two year enlistment - only open to AFQT category I-IIIA HSG, it guarantees a two year term with training in a selected MOS.

The Veteran's Educational Assistance Program (VEAP), implemented after the termination of the GI Bill in 1976, enables an individual to save for post-service education while still in the Army. A soldier contributes from $25 to $100 per month while on active duty (for at least one year). At the same time, the Army matches the personal contribution at a ratio of 2:1. Currently, the maximum total is $7,200 for a two year term and $8,100 for three to four year terms (This includes individual and government contributions).

VEAP kickers (bonus money added for education) are used as an added incentive, attracting high quality individuals to particular MOS or enlistment terms. Also known as the Army College Fund (ACF), VEAP kickers contain funds earmarked specifically for post-service education or training at an approved facility and the government paid portion may not be used for any other purpose. (The total ACF package can amount to over $20,000 for a three or four year enlistment in a specific MOS).

Cash bonuses are another enlistment incentive. They are designed to attract qualified individuals to specific combat and technical MOS. Bonuses currently range from $1,500 to $8,000, and are restricted to high school graduates with above average test (AFQT) scores enlisting for four year terms.

III. THE DEP LOSS MODEL

DEP loss has been shown to be an important "cost" in the recruiting process. This section develops a formal model estimating DEP loss probabilities as a function of various factors. The following section provides estimates of the model's parameters and discusses their significance.

This analysis examines DEP loss as a function of sociodemographic and Army policy variables. Examination of these variables simultaneously makes this project unique among current DEP loss research. Sociodemographic variables are specific to an individual and unchangeable by Army policy. Included are gender, age, marital status, education, AFQT score, prior military service, and region of the country.

Past research has largely ignored policy variables. It is here however, that the Army may have the greatest impact in reducing DEP loss. Counterproductive policies could be revised or eliminated. Conversely, policies leading to lower loss rates could be encouraged. Policy variables examined include contracted length of DEP, training MOS, enlistment term, enlistment bonuses, Army College Fund participation, enlistment options, and month of contract signing. By examining these variables simultaneously with sociodemographic variables, the total DEP loss picture may be more clearly understood.

One of the hypotheses tested is that the longer a person remains in the DEP, the greater the loss risk. The effect of time in DEP was examined using the contract data aggregated into three educational groupings at time of contract: high school graduates (HSG), non-high school graduates (NHS), and high school seniors (HSSR). Figure 1 shows FY82 and FY83 loss rates (first

six months of the fiscal year) for HSGs by length of DEP. An upward trend in loss rate as DEP length increases is clearly evident. Also, while loss rates remained similar at short DEP periods, longer DEP resulted in higher loss rates in FY83. By nine months contracted DEP, the loss rate had exceeded 25 percent. Similar, although more severe results are apparent among NHS contracts (Figure 2). While the loss rate for a nine month DEP was approximately 20 percent in FY82, the rate rose to over 35 percent in FY83.

High school seniors face different DEP constraints than either HSG or NHS contracts. They are permitted longer DEPs (up to one year) and are not fully exposed to the job market while completing school. Therefore, DEP loss patterns are likely to be different from the other two educational groups. This is verified in Figure 3. While loss rates increased with longer contracted DEP, the rise was more gradual, not accelerating as quickly as for HSG and NHS contracts. During the two periods, the loss rate peaked at a little over 8 percent (at ten months contracted DEP in FY82). In contrast with the other two groups, loss rates dropped slightly in FY83.

Two equations were specified for each year: one including both HSG and NHS contracts and another for HSSR contracts. It has already been noted that seniors are under different DEP constraints than HSG or NHS contracts. This was evident when examining the distribution by month in DEP. DEP loss is uncommon for seniors at short periods because of the likelihood that they are still in school and not pursuing other options. Seniors may also be less influenced by current economic conditions, not having been fully exposed to the job market. The effect of DEP policy on HSSRs appears to be longer contracted DEP periods and lower loss rates (when controlling for months in DEP). To use this information fully the separate model was necessary.

Preliminary examination of the data was accomplished using ordinary least squares (OLS) regression. The final combinations of variables were then used in the specification of a maximum likelihood logistic regression (logit) model. Recommended by Amemiya (1981), this two step procedure was followed for several reasons. OLS requires substantially less computing time than the logit. While the algorithm used by the Statistical Analysis System (SAS) completes an OLS run in a single step, several iterations are required for

FIGURE 1

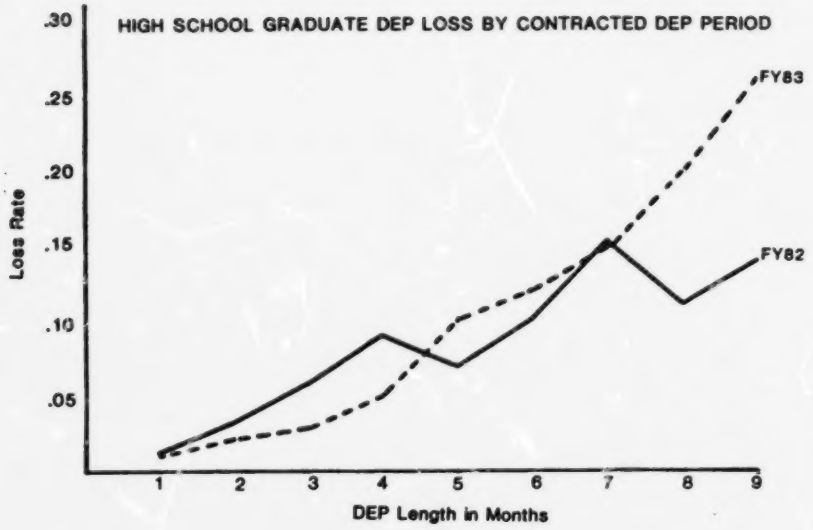


FIGURE 2

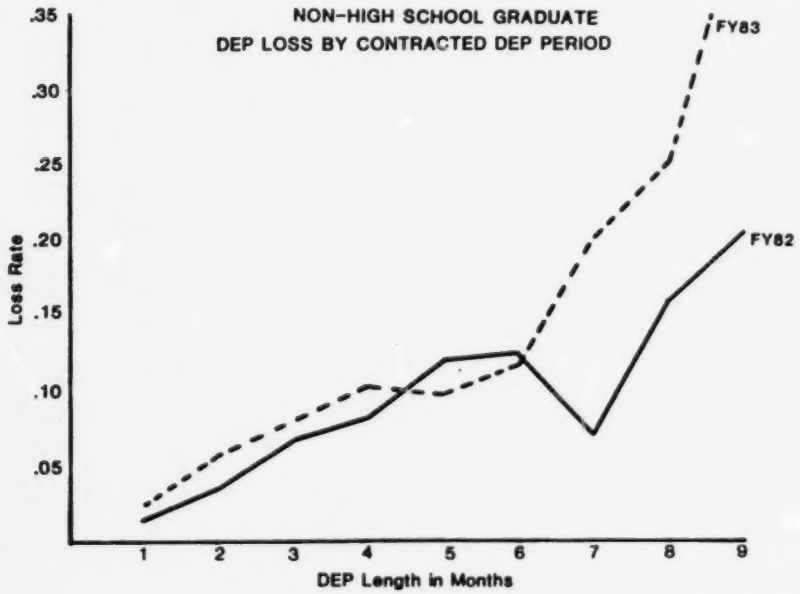
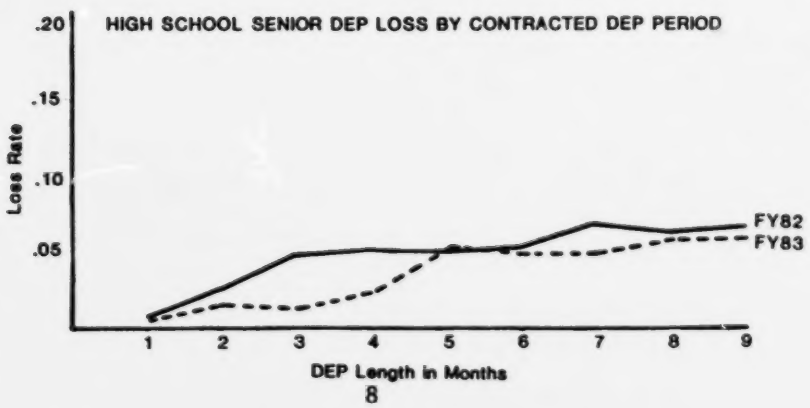


FIGURE 3



the logit. Using OLS for initial estimation permitted a greater number of specification tests, and therefore a more accurate model fit. (Because of biased estimates and the fact that OLS does not constrain values of the dependent variable to between 0 and 1, it could not be used for final parameter specifications.) Due to the greater CPU time requirements for the logit (a single logit run with 15,000 observations and 16 variables required over 111 seconds of CPU time on an IBM 3081) 30-50 percent samples of the original data sets were used for final parameter estimation.

Logit models are particularly well suited where dichotomous variables are used. Based on the cumulative logistic probability function, the maximum likelihood logit restricts values of the dependent variable to between 0 and 1. In this case the dependent variable is the probability of becoming a DEP loss. The logistic distribution function can be expressed as:

$$P(i)= \frac{1}{1+e^{-(A+Bx(i))}}$$

where:

P(i)= Probability of individual becoming a DEP loss
A = Intercept
B = Beta coefficient of independent variable
x(i)= Characteristics of the contract

This model also has other advantages. It enables the use of individual observations rather than grouped data for estimating the probability of success or failure (In this case DEP loss =1). Continuous variables may be used and parameter estimates are consistent and efficient. A more detailed discussion of the logit model can be found in Pindyck and Rubinfeld (1981), Bickel and Doksum (1977), or Amemiya (1981).

Contracts signed during the first six months of FY82 and FY83 were examined using USAREC Minimaster contract files (updated through the end of the fiscal year). While some of these cases remained open at the end of each fiscal year, the number was relatively small (approximately five percent). By using two fiscal year's data, consistency of the effects of variables could be examined. Records with missing or invalid information for the

variables examined were eliminated. The data set included only those persons who participated in the DEP for at least one day. Approximately 95 percent of the total number of cases took one of five primary options (training of choice, unit of choice, station of choice, airborne, and the two year option). In order to limit the analysis to these options, the remaining five percent were eliminated. Approximately 67,000 cases remained for analysis in FY82 and 81,600 cases in FY83. Characteristics of the data sets can be seen on Table 2.

TABLE 2

DATA SET CHARACTERISTICS

VAR	VALUE	N=67,047 FY82	N=81602 FY83
Gender	Male	85.1	86.8
	Female	14.9	13.2
DEP Loss		4.4	5.0
Age	17	20.5	19.6
	18	23.3	24.4
	19	15.8	16.5
	20-22	22.8	23.3
	23-25	9.8	9.3
	Over 25	7.8	6.9
Term	2	5.7	6.3
	3	56.5	58.9
	4-6	37.8	34.8
Original Education	Senior	44.5	32.7
	HSG	46.8	53.6
	NHS	8.7	13.7
Race	White	72.6	74.9
	Non White	27.4	25.1
VEAP Participant		24.9	33.9
Bonus		21.4	18.0
DEP Time	Mean	88.1 Days	111.5 Days
	Std. Dev	84.9	76.9
AFQT	Mean	54.0	56.6
	Std. Dev	21.6	20.3

The distributions of educational groupings by months in DEP were examined for comparison (see appendix B). During the first half of FY82 all three categories had the greatest number of cases contracting DEP periods of one

month or less. There are similar patterns for HSG and NHS contracts, with a general decline in contracts as DEP time increases. Approximately 79 percent of HSG and 80 percent of NHS contracted for periods of four months or less. Seniors, however, experienced a second peak at 6-8 months of DEP. Only 60 percent had DEP periods of four months or less, substantially lower than in the previous two cases.

In general, DEP periods lengthened in FY83. All three educational groups had their greatest number contracting for three months. This extended the average period from 88 days in FY82 to 111 days in FY83. Again, while percentages tailed off for HSG and NHS contracts as DEP time increased, HSSRs reached a second peak at 6-9 months. (Note again that these distributions are associated only with contracts signed the first six months of each fiscal year. Patterns may differ slightly for the entire year.)

IV. RESULTS

As previously noted a total of four models were specified:

- o HSG/NHS for FY82
- o HSSR for FY82
- o HSG/NHS for FY83
- o HSSR for FY83

Using both years enabled a comparison of the consistency of results during different time periods. Alternative representations of variables were considered. For example, AFQT and Time in DEP both best fit the model as continuous rather than categorical variables. Several configurations were also examined for age, enlistment option, bonuses, and ACF participation. Variables examined for the analysis are:

Individual

- o Education at Contract Signing
- o Age
- o Gender
- o Prior Service
- o Race
- o AFQT Score
- o Region of Country

Policy

- o Training MOS
- o Term of Enlistment
- o VEAP Participation
- o VEAP Kicker
- o Length of DEP
- o Month of Contract
- o Enlistment Option

Variables included in the final logit models are race (white,non-white), age (17 versus 18 and 19 year olds in the HSSR model and under 20 versus over 20 in the HSG/NHS model), enlistment term (years), enlistment bonus (Y,N), Army College Fund (Y,N), gender, AFQT (11-99), and DEP period in days. An interaction term was used for non-white females. All variables were in 0,1 form except AFQT and Days in DEP which were continuous variables. Parameter estimates for the four models are included as Appendix C.

Days in DEP was found to have a large impact upon DEP loss. The longer the person remained in the DEP, the greater the risk of loss. While this has been found in other analyses, it has not been investigated in detail as part of a multivariate DEP loss model. Elasticities for this variable ranged from .592 and .626 for the HSG/NHS and HSSR models in FY82, to 1.012 and .991 for the two models, respectively, in FY83. An elasticity is the percentage change in the dependent variable caused by a one percent change in an independent variable, all other variables held constant. (Note: Under normal circumstances elasticities are only reported if statistically significant. In this case all elasticities are reported to better interpret results, since the beta coefficients estimated in the logit are not directly interpretable across equations.) The difference in elasticities indicates that DEP loss became more sensitive to time in DEP during the one year period. A one percent rise in average DEP time using the FY83 models would result in over a one percent rise in DEP loss in both models. Elasticities for all variables are included in Table 3.

The DEP loss models identified females as high risk individuals. This variable was found to yield consistently significant results, all with positive signs. Due to historically lower loss rates for non-white females, they were included in a separate term. This variable was found to be negative and significant in the HSG/NHS models but provided inconsistent results for

TABLE 3

MODEL ELASTICITIES

	HS/NHS MODEL		SENIOR MODEL	
	FY82	FY83	FY82	FY83
Non-White	-.001 (0.00)	.015 (0.38)	-.082* (5.61)	-.060* (3.62)
Age 17	--	--	-.097* (10.61)	-.132* (8.82)
Under 20	-.102* (5.51)	-.167* (23.41)	--	--
Term 2	.011 (1.37)	.008 (0.72)	.004 (0.12)	.000 (0.00)
Term 4	-.017 (0.21)	-.057* (3.60)	.088* (5.10)	-.044 (1.04)
Bonus	-.071* (5.38)	.011 (0.21)	-.156* (20.47)	.005 (0.03)
ACF	-.053* (3.68)	-.047 (2.42)	-.018 (0.31)	-.040 (0.88)
AFQT	-.178 (2.29)	-.247* (4.73)	-.184 (2.09)	.087 (0.28)
DEP	.592* (362.38)	1.012* (622.38)	.626* (125.57)	.991* (104.15)
Female	.126* (60.25)	.112* (65.16)	.163* (135.04)	.137* (115.42)
Non-White Female	-.017* (2.77)	-.030* (10.54)	.001 (0.00)	-.007 (0.88)
Non-High School	.021 (1.69)	.145* (91.68)	--	--

* Significant .10
Chi-Square in parentheses

HSSRs. Elasticities for females dropped slightly in both models for FY83, moving from .126 to .112 in the HSG/NHS model and from .163 to .137 in the HSSR model.

It was estimated in the HSG/NHG models that those under 20 years of age were less likely to become losses than their older counterparts. Similar results were found in the HSSR models, with 17 year olds being less likely to be lost than 18 or 19 year olds.

Several variables had weak but uniform effects. Non-whites had a lower predicted loss probability in three of four cases but it was only significant for HSSRs. The AFQT variable provided unexpectedly weak results. It was found to be statistically significant in only one of four cases (HSG/NHS model in FY83). While it is negative in both HSG/NHS specifications, it is positive (but not significant) in the case of HSSRs in FY83. Term of service generally was not statistically significant. This indicates that enlistment term presents little information for the prediction of DEP loss.

Enlistment options and incentives provided inconclusive results. In early specification runs, training of choice was the only enlistment option found to produce significantly different DEP loss rates. When included in the logit models, however, it provided poor results. It was therefore dropped from the final model specification. Those who did not sign for the ACF were more likely to be lost than those who did. This was true in all four cases (one significant). Results for enlistment bonuses also proved inconclusive, producing significantly lower DEP loss in FY82, but positive and not significant results in FY83.

Several of the variables chosen for analysis were not found to be statistically significant and were therefore dropped. It is possible that other interpretations of these variables could lead to significant DEP loss relationships. Region of the country (Recruiting region) is one such case. Although not found to be statistically significant during specification, particular locales may produce statistically different loss rates. The same holds true for training MOS and month of contract. Due to the large number of possible MOS and CPU time limitations of the logit, a sample of large

representative MOS was taken. This may not have identified all MOS differences. An especially attractive high-tech MOS may have a significantly lower loss rate, for example. However, it is likely that such differences would only marginally affect aggregate projections. Since only contracts for the months of October-March in each year were used, monthly patterns for the total year could not be examined. Prior military service was not found to be significant. Marital status was not included due to a high percentage of missing cases.

V. POLICY IMPLICATIONS

For the remainder of the analysis, contracts were broken into fourteen supply groups. These groupings are consistent with those being used for the Enlisted Personnel Allocation System (EPAS) being developed at ARI (McWhite et al. 1984) They are:

1. Male upper quartile (AFQT 75+) HSG.
2. Male second quartile (AFQT 50-74) HSG.
3. Male third quartile (AFQT 31-49) HSG.
4. Male fourth quartile (AFQT 11-30) HSG.
5. Male upper quartile HSSR.
6. Male second quartile HSSR.
7. Male third quartile HSSR.
8. Male fourth quartile HSSR.
9. Male upper half (AFQT 50+) NHS.
10. Male lower half (AFQT <50) NHS.
11. Female upper half HSG.
12. Female lower half HSG.
13. Female upper half HSSR.
14. Female lower half HSSR.

To examine the effect of particular policies and characteristics upon DEP loss, several scenarios were modeled. These include:

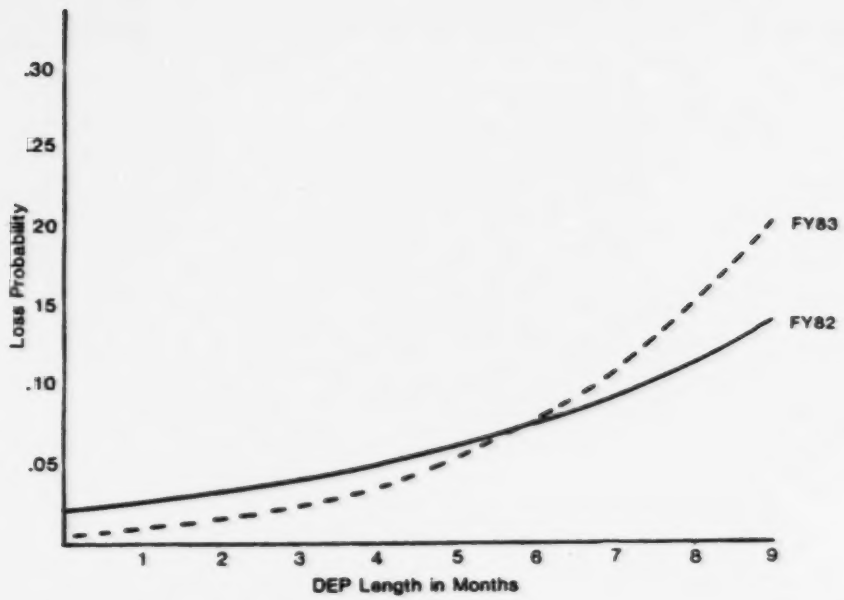
- o Time in DEP.
- o AFQT differences.
- o Enlistment and incentive options.

In the first scenario, the effect of time in DEP is examined. Particular supply groups are studied, with variables other than time in DEP held constant. Figure 4 shows graphically the loss probability by contracted months in DEP for a typical upper quartile male HSG (white, AFQT 85, three year enlistment, no options taken). As was evident from observed data, the model predicts much higher loss probabilities for long contracted DEP periods in FY83. At six months contracted DEP, the FY83 loss probability exceeds 8 percent. Few HSG contracts remain in the DEP this long, however.

FIGURE 4

PREDICTED DEP LOSS PROBABILITY

MALE HIGH SCHOOL GRADUATE, AFQT 85



A contrast can be seen when the previous results are compared to an HSSR with identical characteristics. Table 4 shows that the predicted loss rate actually fell slightly in FY83, with a loss probability of only a little over 3 percent at six months DEP. This is less than one half the loss probability for a HSG.

TABLE 4

PREDICTED DEP LOSS PROBABILITIES

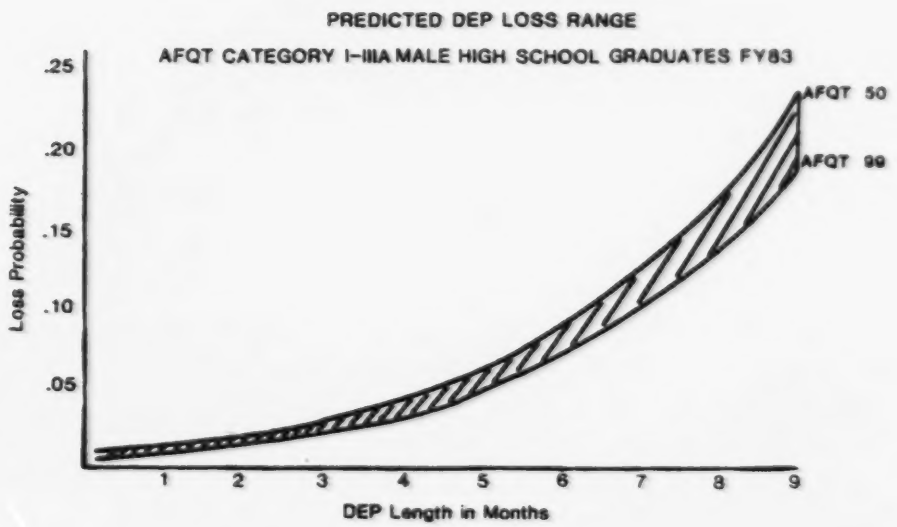
Months In DEP		MALE			FEMALE	
		HSG*	HSSR*	NHS**	HSG**	HSSR**
FY82	1	.019	.013	.023	.046	.050
	2	.024	.018	.030	.059	.059
	3	.031	.019	.039	.075	.070
	4	.040	.022	.050	.095	.082
	5	.052	.027	.064	.120	.097
	6	.066	.032	.082	.150	.108
	7	.085	.038	.103	.187	.133
	8	.107	.045	.130	.230	.155
	9	.135	.053	.162	.280	.180
FY83	1	.013	.013	.031	.033	.044
	2	.019	.015	.045	.048	.053
	3	.028	.018	.065	.069	.062
	4	.040	.021	.092	.098	.074
	5	.058	.026	.129	.137	.087
	6	.082	.031	.178	.189	.103
	7	.116	.037	.241	.254	.121
	8	.161	.044	.318	.333	.141
	9	.219	.052	.405	.422	.164

White, Three Year Enlistment, No Options
* Evaluated at AFQT = 85
** Evaluated at AFQT = 60

These are both low risk categories of individuals, however. Non-high school graduates and females have much higher predicted loss probabilities. At six months DEP (very few NHS contracts are permitted to DEP longer), the loss probability for a male NHS Graduate (AFQT 60) is close to .18 in FY83, over twice the predicted FY82 loss rate. The contrast between years is even more distinct in the case of females. The predicted loss probability at six months for a female HSG (AFQT 60) is approximately .19 in FY83. Female HSSRs experience lower predicted loss rates and a representative of this group had a predicted loss probability of about .10 at six months contracted DEP in FY83. With the exception of HSSRs, all groups experience higher loss probabilities at long DEP periods in FY83 models.

AFQT plays a minor part in the DEP loss models. Coefficients were generally small and not significant. Figure 5 examines predicted loss probability range for AFQT category I-IIIA (AFQT 50-99) male HSG contracts (white, three year term, no options). At four months contracted DEP (a typical DEP period), the difference is less than one percent in the loss probability, and only four percent at nine months.

FIGURE 5



The effects of enlistment and incentive options were examined. In each case, a white male with an AFQT score of 85 and four year enlistment term (most likely term for having taken options) was chosen. Only time in DEP was varied. In this manner, the relative effect of having taken an enlistment bonus, the Army College Fund, both options, or neither could be examined for HSGs and HSSRs at different DEP periods. In FY82 a contract who had taken the ACF, bonus, or both would have had a lower loss probability than having taken no incentive. The lowest projected loss probability was for a person enlisting with a bonus and ACF (Results can be seen in appendix D). Figure 6 points out graphically the contrast in loss rates at a DEP period of four months. A high school graduate with an enlistment bonus and ACF in FY82 would have had a projected DEP loss probability of two percent, about half the loss probability for the same person taking no options. The same relationship holds true for an HSSR.

As previously noted, the effect of all options diminished in FY83. In this case the results were not statistically significant and therefore inconclusive.

VI. SUMMARY AND CONCLUSIONS

The analysis presented indicates that predictable DEP loss patterns do occur. Several of the findings concur with those found by others:

- Females exhibit higher loss rates than males.
- Less educated persons have greater projected loss rates.
- The risk of DEP loss increases with increased time in the DEP.

While these findings are not new, examining these variables simultaneously produced some interesting results. In FY83 female HSSRs had lower loss probabilities than all except male HSSRs (when all other variables are controlled for). Earlier analyses could not have predicted this. Also found was a great contrast between HSSRs and HSG/NHS contracts.

FIGURE 6

EFFECT OF ENLISTMENT OPTIONS AT FOUR MONTHS DEP

(White Male, AFQT 85, 4 Year Enlistment)

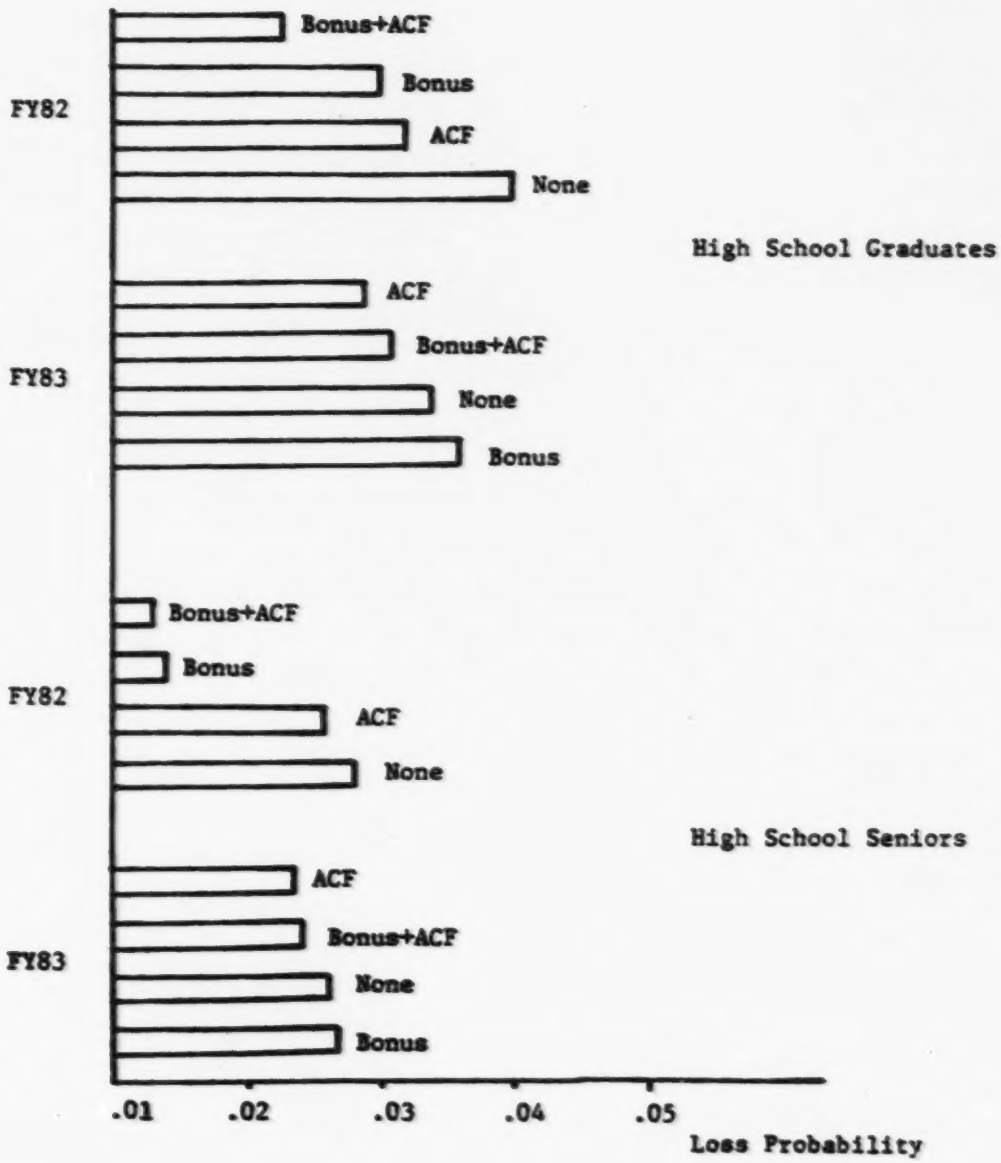


FIGURE 7

DEP LOSS RISK CATEGORIES- FY82

(Evaluated at 4 Month DEP, 3 Year Term, No Options, Age 18)

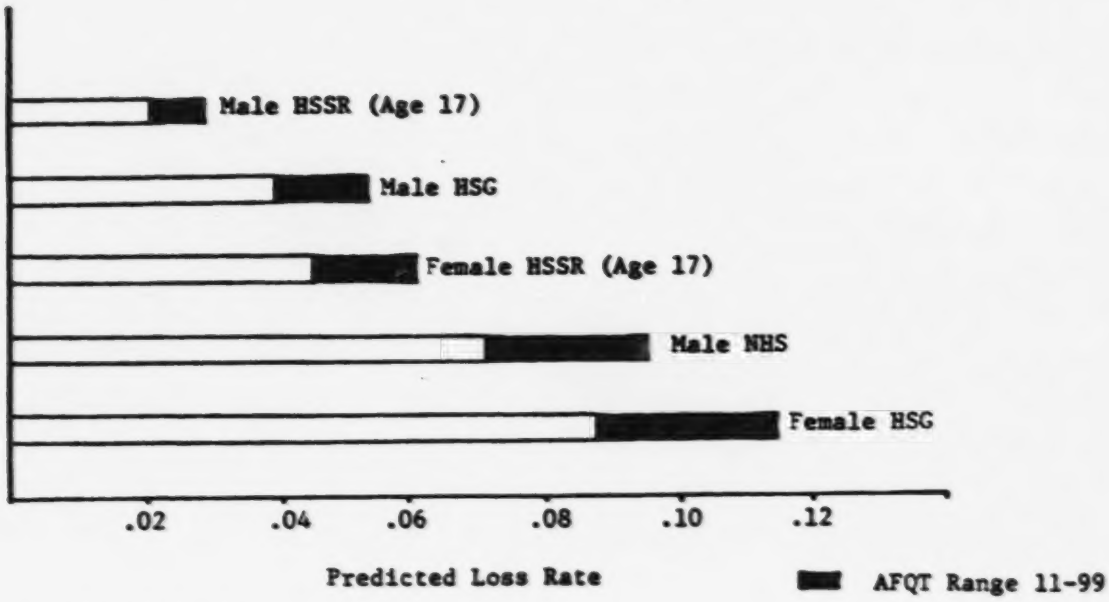
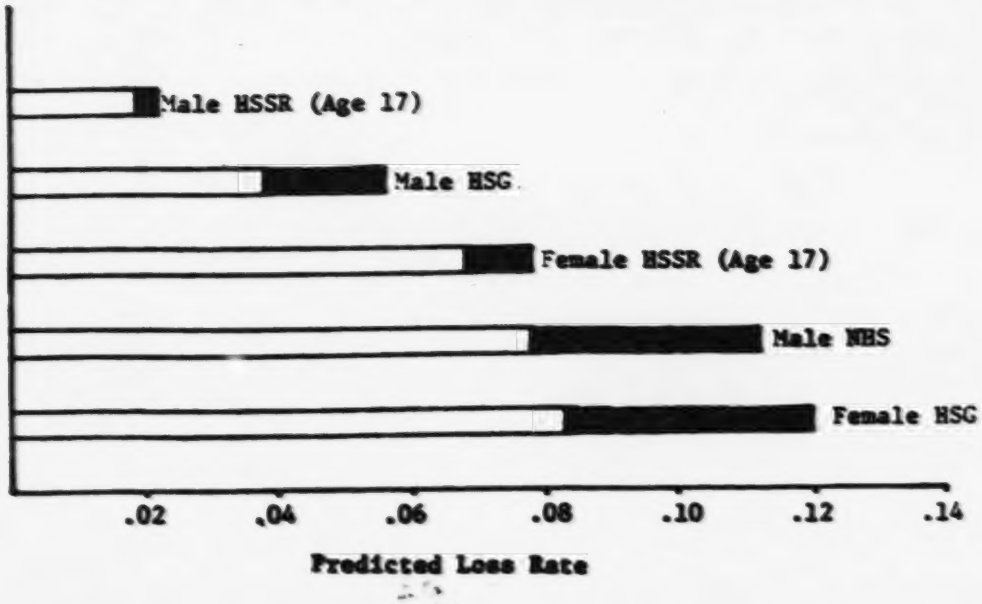


FIGURE 8

DEP LOSS RISK CATEGORIES- FY83

(Evaluated at 4 Months DEP, 3 Year Term, No Options, Age 18)



From the models, high and low risk supply categories can be identified. Figures 7 and 8 provide a ranking of these groups, evaluated at 4 months DEP. (Results were estimated for a 3 year term and taking no options. In order to provide accurate comparisons, HSGs and NHS graduates were evaluated at age 18 while HSSRs were estimated at age 17.). AFQT ranges are also shown. As expected, male HSSRs present the lowest risk as a group, with a small AFQT range (less than one percent). This indicates that all male HSSRs should be treated similarly with respect to DEP loss. Male HSGs present the second lowest risk. In this case the AFQT differences are broader (about 1.5 to 2 percent). Female HSSRs were next, followed by male NHS graduates. Female HSGs were the highest risk category. As shown in the figures, there is some overlapping of predicted loss rates. For example, in Figure 11 predicted loss probabilities for male NHS graduates range from 7.2 to 9.6 percent and range from 8.8 to 11.5 percent for female HSGs.

Some of the other findings presented here have not previously been reported:

- Prior military service was not found to be significant in predicting DEP loss.
- There was no measurable difference in predicted rates from different regions of the country.
- Non-white females exhibited lower loss rates than white females.
- Training MOS was not found to be significant.

If the sole objective of recruiting was to sign individuals who assured minimum DEP loss, generalizations could be made based upon this analysis. Contracted DEP lengths should be kept as short as possible. Continue recruiting as many male AFQT category I-IIIA HSGs and HSSRs as possible. They are in the lowest DEP loss risk categories. Get as many 17 and 18 year olds as possible to sign contracts. Limit the number of NHS graduates recruited. Encourage the use of some of the enlistment and incentive options associated with lower DEP loss.

It is not reasonable to assume, however, that recruiting strictly to achieve minimum DEP loss is attainable or even desirable. There are tradeoffs to be made with other Army policies (such as longer DEP periods being associated with lower attrition rates). The factors associated with DEP loss need to be systematically compared to behavior after enlisting.

The results of this analysis can be best used to identify those individuals already within the system most likely to become DEP losses. These persons could then be monitored. For example, while an HSG male with an AFQT score of 90 enlisting for two years is generally a low risk individual, he would become a high risk at a DEP length of eight months.

The DEP loss model presented here could also be used in conjunction with one of the models currently used to forecast contracts in order to ultimately forecast accessions. The number of losses could be projected by the characteristics of the people in the DEP. This would provide a better indication of the number and type of accessions than simply decreasing the number of contracts in a blanket fashion.

The models have been very successful in explaining DEP behavior. Systematic knowledge has been developed concerning which factors do and do not relate to DEP loss. This analysis has also identified three areas where additional DEP research would be beneficial:

- o DEP loss trends.
- o The impact of the DEP on recruiting productivity.
- o The relationship between enlistment policies and post-enlistment behavior.

This model of DEP behavior was developed from cross-sectional data. This tends to hold constant many significant factors, such as the economy, relative military to civilian pay, and social attitudes toward the military. (While differences over time were examined somewhat by using data from two different years, further research is necessary.) It would be important to explore whether these kinds of factors significantly affect people in the DEP. Knowledge of these relationships would enhance the ability to forecast enlistments from contracts.

The DEP affects recruiter productivity. USAREC would benefit by having an improved model of the implicit costs associated with DEP management. Such information could lead to increased recruiter output. For example, an improved system for allocating recruiting resources between contracting and DEP management could be helpful in increasing recruiter output.

Finally, the DEP needs to be examined from the standpoint of effective personnel management. For example, while time in DEP may lead to higher pay and greater use of recruiting resources, it also has been shown to lower attrition. Other enlistment policies (e.g. ACF) may reduce both DEP loss and attrition. A thorough analysis on the impact of these policies should be done to develop programs that achieve total Army goals.

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APPENDIX A
DEP CONTROL MESSAGE

USAREC MESSAGE

1012002 DEC 82 ROUTINE UNCLAS USAREC MSG#82-192 PART I

FROM: CDRUSAREC FT SHERIDAN IL.
TO: RRC/DRC COMMANDERS AND GUIDANCE COUNSELORS

SUBJECT: USAR ACCESSION CONTROL MEASURES

1. EFFECTIVE 28 DECEMBER 82. THE FOLLOWING USAR ACCESSION CONTROLS ARE IN EFFECT:

NPS MALES	AFQT GROUPING	RESTRICTED TO
GM/SM	31-99	270 DAYS
GM/SM	16-30	90 DAYS
CIHS	50-99	180 DAYS
CIHS	16-49	CLOSED
NM/GED	31-99	90 DAYS **
NM/GED	16-30	CLOSED

NPS FEMALE	AFQT GROUPING	RESTRICTED TO
GF/SF	31-99	270 DAYS
GF/SF	16-30	CLOSED
CIHS	50-99	180 DAYS
CIHS	16-49	CLOSED
NF/GED	16-99	CLOSED **
PRIOR SERVICE	NA	NA

ASTERISKED ITEMS (**) INDICATE CHANGES TO ACCESSION CONTROL MEASURES CURRENTLY INFORCE.
2. EFFECTIVE 28 DECEMBER 82. ALL USAR MALE GED ACCESSIONS WILL BE ACCESSED AS NON HIGH SCHOOL GRADS.
3. NO GED FEMALES WILL BE ACCESSED EFFECTIVE 28 DECEMBER 82.
4. ALL FEMALE MORAL COMMITMENTS WILL BE FULLFILLED BY 27 DECEMBER 82. NO EXCEPTION WILL BE GRANTED.
5. POC THIS HEADQUARTERS: USARCRO-O THROUGH REGION IS CPT ROGERS/SFC(P) DELBARTO. AV 459-2325/2747. CML (312) 926-2325/2747.

ROBERT A. LINGO. COL. GS. DEPUTY DIRECTOR RECRUITING OPERATIONS

1015002 DEC 82 ROUTINE UNCLAS USAREC MSG#82-192 PART II

FROM: CDRUSAREC FT SHERIDAN IL
TO: RRC/DRC COMMANDERS AND GUIDANCE COUNSELORS

SUBJECT: PUSH MOS MISSIONS

A. USAREC REQUEST MSG#82-187. DTG 291000Z NOV 82. SUBJ: PUSH MOS MISSIONS. THIRD QUARTER. FY 83

1. MOS 35C HAS BEEN CLOSED TO RECRUITING FOR FY 83. AND IS DELETED FROM REF A.

2. EFFECTIVE IMMEDIATELY. MOS 43E IS ADDED TO PUSH MOS MISSIONS BEGINNING WITH RSM FEB THRU JUN 83. RRC ARE MISSIONED FOR MOS 43E AS FOLLOWS:

RSM	NE	SE	SW	MW	W	TOTAL
FEB	17	17	11	20	11	76
MAR	18	18	11	21	11	79
APR	23	23	15	24	15	100
MAY	30	30	19	32	19	130
JUN	12	12	8	13	8	53

3. POC THIS HQ. USARCRO-O. MAJ KILLAM/MSG SEABROOK. AV 459-3320 CML 312-926-3320.

NOEL D. GREGG. COL. GS. DIRECTOR. RECRUITING OPERATIONS

APPENDIX B

DISTRIBUTION BY MONTHS IN DEP - FY 82

MONTHLY PERCENTAGE DISTRIBUTION OF DEP LENGTHS

FY82

Months in DEP	High School Graduates	High School Seniors	Non-Graduates
1	38.11	27.07	38.90
2	26.64	18.88	26.19
3	10.27	8.31	10.44
4	3.98	5.31	4.34
5	3.75	5.39	2.79
6	4.31	7.86	2.82
7	3.03	8.12	8.00
8	3.97	8.58	2.77
9	3.47	6.26	2.22
10	1.61	2.45	1.09
11	0.43	1.17	0.18
12	0.39	0.60	0.25
TOTAL	100.0	100.0	100.0

APPENDIX B - con't

DISTRIBUTION BY MONTHS IN DEP - FY 83

MONTHLY PERCENTAGE DISTRIBUTION OF DEP LENGTHS

FY83

Months in DEP	High School Graduates	High School Seniors	Non-Graduates
1	7.90	4.57	7.42
2	22.57	8.81	15.19
3	41.99	15.12	49.04
4	12.80	5.18	13.61
5	5.06	6.02	5.71
6	3.71	10.24	4.09
7	2.47	13.53	2.21
8	1.54	12.40	1.31
9	0.85	10.44	0.59
10	0.58	7.54	0.33
11	0.33	3.55	0.30
12	0.30	2.61	0.19
TOTAL	100.0	100.0	100.0

APPENDIX C

LOGISTIC REGRESSION RESULTS

HS/NHS MODEL

	FY82	FY83
MODEL CHI-SQUARE	681.78 (11)	962.40 (11)
MODEL R	.304	.317
-2 LOG LIKELIHOOD	5638.27	7037.18
N	14989	16603
INTERCEPT	-3.6636 ***	-3.9474 ***
NON-WHITE	- .0051	.0610
UNDER 20	- .2131 **	- .3590 ***
TERM 2	.2357	.1502
TERM 4-6	- .0465	- .1834 *
ENLISTMENT BONUS	- .3466 **	.0656
ACF	- .2297 *	- .1617
AFQT	- .0034	- .0046 **
DEP	.0087 ***	.0127 ***
FEMALE	.8273 ***	.8394 ***
NON-WHITE FEMALE	- .3158 *	- .6396 ***
NHS	.1365	.7692 ***

* SIG .1
** SIG .05
*** SIG .01

APPENDIX C
LOGISTIC REGRESSION RESULTS- continued
SENIOR MODEL

	FY82	FY83
MODEL CHI-SQUARE	461.96 (10)	268.09 (10)
MODEL R	.274	.219
-2 LOG LIKELIHOOD	4928.65	4324.13
N	14986	13107
INTERCEPT	-3.8548 ***	-4.3596 **
NON-WHITE	- .3117 **	- .2741 *
AGE 17	- .3371 ***	- .3063 ***
TERM 2	.0704	- .0055
TERM 4-6	.2362 **	- .1176
ENLISTMENT BONUS	- .7454 ***	.0244
ACF	- .0717	- .1113
AFQT	- .0036	.0016
DEP	.0060 ***	.0061 ***
FEMALE	1.2760 ***	1.3091 ***
NON-WHITE FEMALE	.0054	- .2565

* SIG .1
** SIG .05
*** SIG .01

APPENDIX D

PREDICTED DEP LOSS PROBABILITIES USING ENLISTMENT INCENTIVE - FY82
(Male, 4 Year Term, AFQT 85)

	DEP IN DAYS	NONE	ACF	BONUS	ACF BONUS
HSG	<1	.015	.012	.010	.008
	1	.019	.015	.013	.011
	2	.024	.019	.017	.014
	3	.031	.015	.022	.018
	4	.040	.032	.029	.023
	5	.052	.041	.037	.030
	6	.066	.054	.048	.038
	7	.085	.068	.061	.049
	8	.107	.087	.078	.063
	9	.135	.110	.099	.080
HSSR	<1	.019	.018	.009	.009
	1	.023	.022	.011	.010
	2	.027	.026	.013	.012
	3	.032	.031	.016	.015
	4	.039	.036	.019	.018
	5	.046	.043	.022	.021
	6	.055	.051	.027	.025
	7	.065	.061	.032	.030
	8	.077	.072	.038	.035
	9	.060	.085	.045	.042

PREDICTED DEP LOSS PROBABILITIES USING
ENLISTMENT INCENTIVE - FY83
(Male, 4 Year Term, AFQT 85)

	MONTHS IN DEP	NONE	ACF	BONUS	ACF+ BONUS
HSG	<1	.007	.006	.008	.007
	1	.011	.009	.012	.010
	2	.016	.014	.017	.015
	3	.023	.020	.025	.021
	4	.034	.029	.036	.031
	5	.048	.042	.052	.044
	6	.069	.060	.074	.064
	7	.099	.085	.105	.090
	8	.138	.119	.146	.127
	9	.190	.166	.200	.176
HSSR	<1	.004	.003	.004	.003
	1	.004	.004	.004	.004
	2	.005	.005	.005	.005
	3	.006	.006	.006	.006
	4	.007	.008	.007	.007
	5	.008	.009	.009	.008
	6	.011	.011	.011	.010
	7	.013	.013	.013	.012
	8	.015	.014	.015	.014
	9	.018	.016	.018	.017

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